CLAIMS

1. A semiconductor light emitting device comprising:

a multilayer epitaxial structure including a first conductive layer, a second conductive layer, and a light emitting layer between the first conductive layer and the second conductive layer, a main surface of the second conductive layer which faces away from the light emitting layer being a light extraction surface;

a first electrode formed on a main surface of the first conductive layer which faces away from the light emitting layer;

a second electrode formed on the main surface of the second conductive layer which faces away from the light emitting layer;

a first power supply terminal that is electrically connected to the first electrode and forms at least part of a metal layer, the multilayer epitaxial structure being formed on the metal layer in such a manner that the first conductive layer is closer to the metal layer than the second conductive layer is, the metal layer supporting the multilayer epitaxial structure, and conducting heat generated in the light emitting layer; and

a second power supply terminal that is electrically connected to the second electrode by means of a conductive member which extends from the second electrode in a direction parallel to the main surface of the second conductive layer.

2. The semiconductor light emitting device of Claim 1, wherein

the metal layer is electrically divided into at least two portions, and

at least one of the portions is constituted as the first power supply terminal, and at least one of a rest of the portions is connected to the second electrode, to be constituted as the second power supply terminal.

3. The semiconductor light emitting device of Claim 1, wherein

the second power supply terminal forms a conductive film on a surface of the metal layer on which the multilayer epitaxial structure is formed, and an insulating film is formed between the second power supply terminal and the surface of the metal layer.

4. The semiconductor light emitting device of Claim 3, wherein

the first power supply terminal forms the entire metal layer.

5. The semiconductor light emitting device of Claim 3, wherein

the conductive film is formed so as to surround the multilayer epitaxial structure, and is also constituted as a light-reflective film.

6. The semiconductor light emitting device of Claim 1, wherein

the first electrode is formed on substantially the entire main surface of the first conductive layer which faces away from the light emitting layer, and reflects light emitted from the light emitting layer.

7. The semiconductor light emitting device of Claim 1, wherein the second electrode is a transparent electrode which transmits the light emitted from the light emitting layer.

8. The semiconductor light emitting device of Claim 7, wherein the second electrode is formed on substantially the entire main surface of the second conductive layer which faces away from the light emitting layer.

9. The semiconductor light emitting device of Claim 1, further comprising:

a phosphor layer formed on the multilayer epitaxial structure so as to cover the main surface of the second conductive layer which faces away from the light emitting layer, the phosphor layer including a light emitting substance which is excited by the light emitted from the light emitting layer, to emit light.

10. The semiconductor light emitting device of Claim 1, wherein

each of the first conductive layer, the light emitting layer, and the second conductive layer is made of a compound semiconductor including nitrogen.

11. A semiconductor light emitting device comprising:

a light emitting element array formed in such a manner that a plurality of light emitting elements are connected in series, each of the plurality of light emitting elements including: (a) a multilayer epitaxial structure including

a first conductive layer, a second conductive layer and a light emitting layer between the first conductive layer and the second conductive layer, a main surface of the second conductive layer which faces away from the light emitting layer being a light extraction surface, (b) a first electrode formed on a main surface of the first conductive layer which faces away from the light emitting layer, and (c) a second electrode formed on the main surface of the second conductive layer which faces away from the light emitting layer, the first electrode and the second electrode are positioned to each other in a same manner for each light emitting element; and

a metal layer on which the light emitting element array is formed, with an insulating layer therebetween, in such a manner that the first electrode is positioned closer to the metal layer than the second electrode is, the metal layer connecting and supporting the multilayer epitaxial structures and conducting heat generated in the light emitting layer, wherein

the metal layer is electrically divided into at least two portions,

at least one of the portions is connected to a first electrode of a light emitting element at one end of the light emitting element array, to be constituted as a first power supply terminal, and

at least one of a rest of the portions is connected to a second electrode of a light emitting element at the other end of the light emitting element array, by means of a conductive member which extends from the second electrode

in a direction parallel to a main surface of a second conductive layer of the light emitting element, to be constituted as a second power supply terminal.

12. The semiconductor light emitting device of Claim 11, wherein

the first electrode is formed on substantially the entire main surface of the first conductive layer which faces away from the light emitting layer, and reflects light emitted from the light emitting layer.

13. The semiconductor light emitting device of Claim 11, wherein

the second electrode is a transparent electrode which transmits the light emitted from the light emitting layer.

14. The semiconductor light emitting device of Claim 13, wherein

the second electrode is formed on substantially the entire main surface of the second conductive layer which faces away from the light emitting layer.

15. The semiconductor light emitting device of Claim 11, further comprising:

a phosphor layer formed on the multilayer epitaxial structure so as to cover the main surface of the second conductive layer which faces away from the light emitting layer, the phosphor layer including a light emitting substance which is excited by the light emitted from the light emitting

layer, to emit light.

16. The semiconductor light emitting device of Claim 11, wherein

each of the first conductive layer, the light emitting layer, and the second conductive layer is made of a compound semiconductor including nitrogen.

17. A lighting module comprising:

a printed wiring board including a bonding pad; and

a semiconductor light emitting device as defined in one of Claims 1 to 16, the semiconductor light emitting device being mounted on the printed wiring board by connecting a metal layer included in the semiconductor light emitting device to the bonding pad.

18. A lighting apparatus comprising a lighting module as defined in Claim 17.

19. A manufacturing method of a semiconductor light emitting device, comprising steps of:

forming a multilayer epitaxial structure by epitaxial growth on one of main surfaces of a single-crystal substrate, the multilayer epitaxial structure including a first conductive layer, a second conductive layer, and a light emitting layer between the first conductive layer and the second conductive layer, the second conductive layer being positioned closer to the main surface than the first conductive layer is;

forming a first electrode on a main surface of the first conductive layer which faces away from the light emitting layer;

forming a metal layer so as to be closer to the first electrode than to the second electrode, the metal layer supporting the multilayer epitaxial structure;

separating the single-crystal substrate from the multilayer epitaxial structure;

forming a second electrode on a main surface of the second conductive layer which faces away from the light emitting layer; and

dividing the metal layer electrically into at least two portions.

20. The manufacturing method of Claim 19, wherein

in the metal layer forming step, the metal layer is electrically connected to the first electrode, and

in the metal layer dividing step, one or more of the portions are insulated from the first electrode,

the manufacturing method further comprising a step of:

electrically connecting the portions of the metal layer which are insulated from the first electrode, to the second electrode.

21. The manufacturing method of Claim 19, further comprising steps of:

forming an insulating layer on a surface of the first electrode which faces away from the first conductive layer; and

connecting at least one of the portions created in the metal layer dividing step electrically to the first electrode, and connecting at least one of a rest of the portions electrically to the second electrode, wherein

in the metal layer forming step, the metal layer is formed on the insulating layer.

22. The manufacturing method of Claim 19, further comprising a step of:

forming a phosphor layer on the multilayer epitaxial structure so as to cover the main surface of the second conductive layer which faces away from the light emitting layer, the phosphor layer including a light emitting substance that is excited by light emitted from the light emitting layer, to emit light.

23. The manufacturing method of Claim 19, wherein

in the separating step, a laser beam is irradiated to the single-crystal substrate to weaken bonding between the single-crystal substrate and the multilayer epitaxial structure, and the single-crystal substrate is then physically separated from the multilayer epitaxial structure.

24. The manufacturing method of Claim 19, wherein

in the separating step, the single-crystal substrate is ground to be removed.

25. A manufacturing method of a semiconductor light emitting device, comprising steps of:

forming a multilayer epitaxial structure by epitaxial growth on one of main surfaces of a single-crystal substrate, the multilayer epitaxial structure including a first conductive layer, a second conductive layer, and a light emitting layer between the first conductive layer and the second conductive layer, the second conductive layer being positioned closer to the main surface than the first conductive layer is;

dividing the multilayer epitaxial structure into a plurality of portions;

forming a first electrode on a main surface of the first conductive layer which faces away from the light emitting layer, in each of the plurality of portions;

forming an insulating layer, in each portion, on a surface of the first electrode which faces away from the first conductive layer;

forming a metal layer on the insulating layer, the metal layer supporting the multilayer epitaxial structure and connecting the plurality of portions together;

separating the single-crystal substrate from the multilayer epitaxial structure;

forming a second electrode on a main surface of the second conductive layer which faces away from the light emitting layer, in each portion;

connecting the first electrode of each of the plurality of portions to a second electrode of a different one of the plurality of portions by means of a conductive member, in series;

dividing the metal layer electrically into at least two

portions; and

electrically connecting a first electrode of one of the plurality of portions of the multilayer epitaxial structure at one end, to at least one of the portions of the metal layer, and electrically connecting a second electrode of another one of the plurality of portions of the multilayer epitaxial structure at the other end, to at least one of a rest of the portions of the metal layer.

26. The manufacturing method of Claim 25 further comprising a step of:

forming a phosphor layer on the multilayer epitaxial structure so as to cover the main surface of the second conductive layer which faces away from the light emitting layer, the phosphor layer including a light emitting substance that is excited by light emitted from the light emitting layer, to emit light.

27. The manufacturing method of Claim 25, wherein

in the separating step, a laser beam is irradiated to the single-crystal substrate to weaken bonding between the single-crystal substrate and the multilayer epitaxial structure, and the single-crystal substrate is then physically separated from the multilayer epitaxial structure.

28. The manufacturing method of Claim 25, wherein

in the separating step, the single-crystal substrate is ground to be removed.